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(56) Documents Cited
EP 0355912 A2 JP 080048193 A

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(54) Abstract Title
Composite structure

(57) A composite structure 2 particularly for use in the automotive field is disclosed in which a core 4 of load bearing, impact resistant material is provided with a first layer 6 of a laminate composite comprising aligned continuous glass fibres in a matrix of a thermoplastic material on a first side of the core and a second layer 8 of a laminate composite comprising aligned continuous glass fibres in a matrix of a thermoplastic material on a second side of the core. The core may be a foam or a honeycomb. Such a structure has the advantage that it provides, or may readily be provided with, a suitable aesthetic finish to a part formed from the composite structure, the composite structure having an inherent rigidity such that no additional supporting members are required.

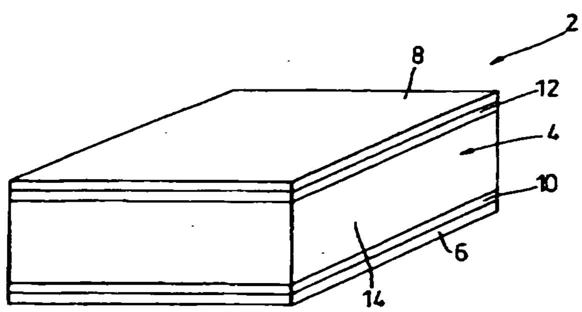

Fig. 1

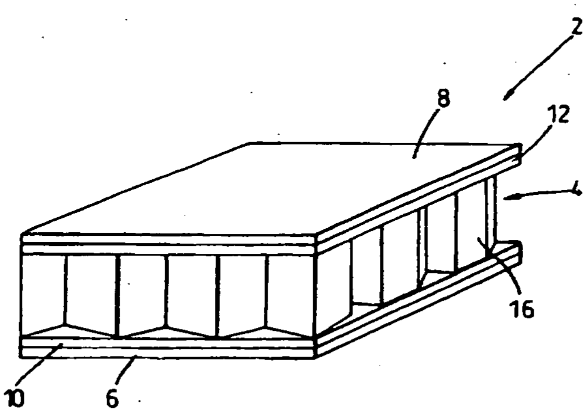

Fig. 2

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

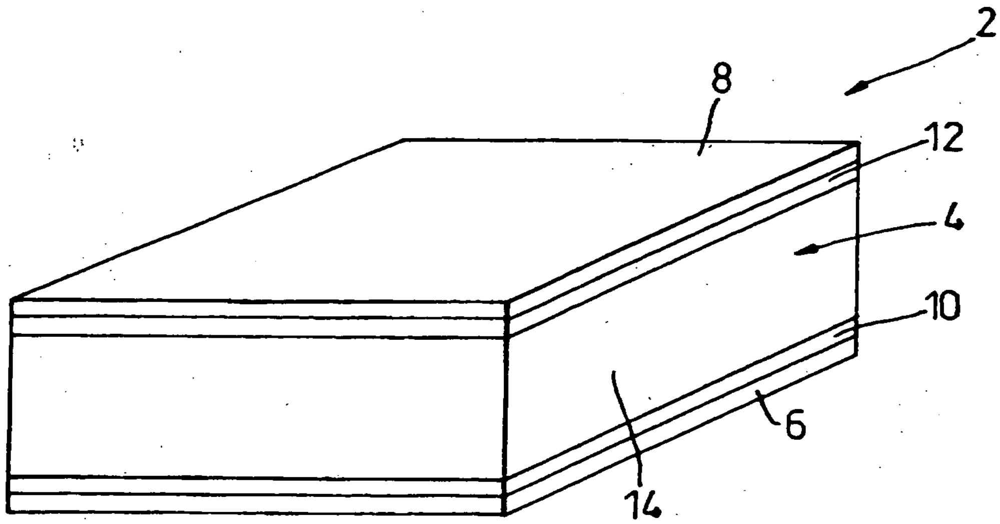

Fig. 1

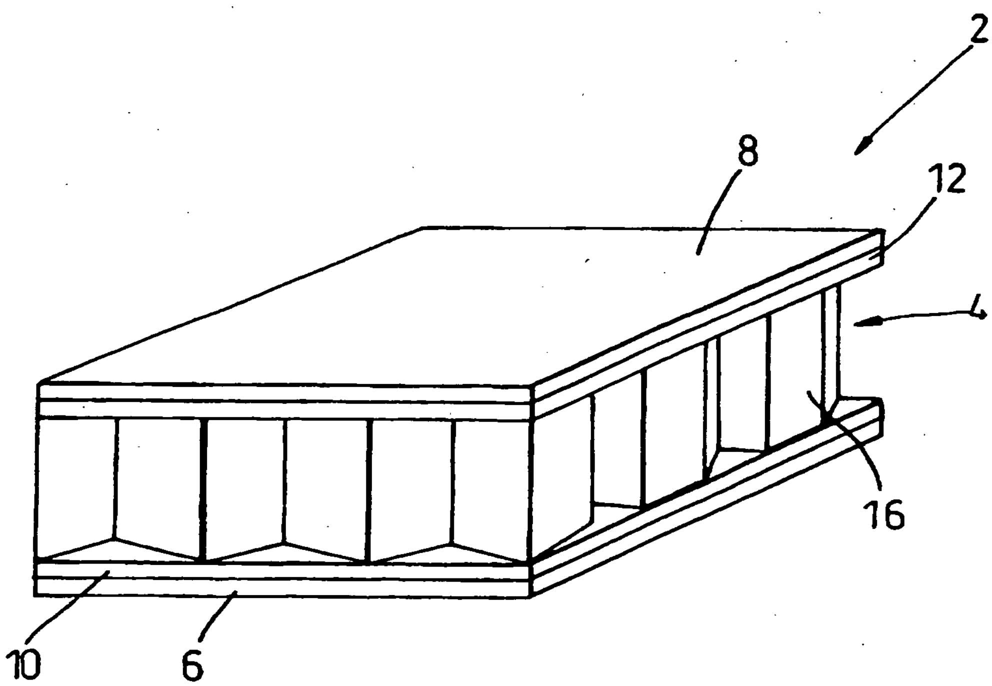

Fig 2

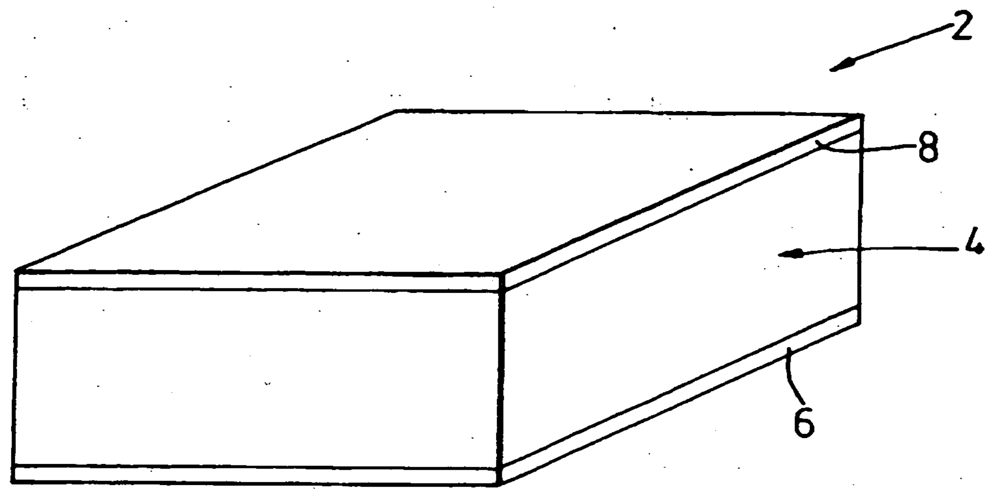

Fig. 3

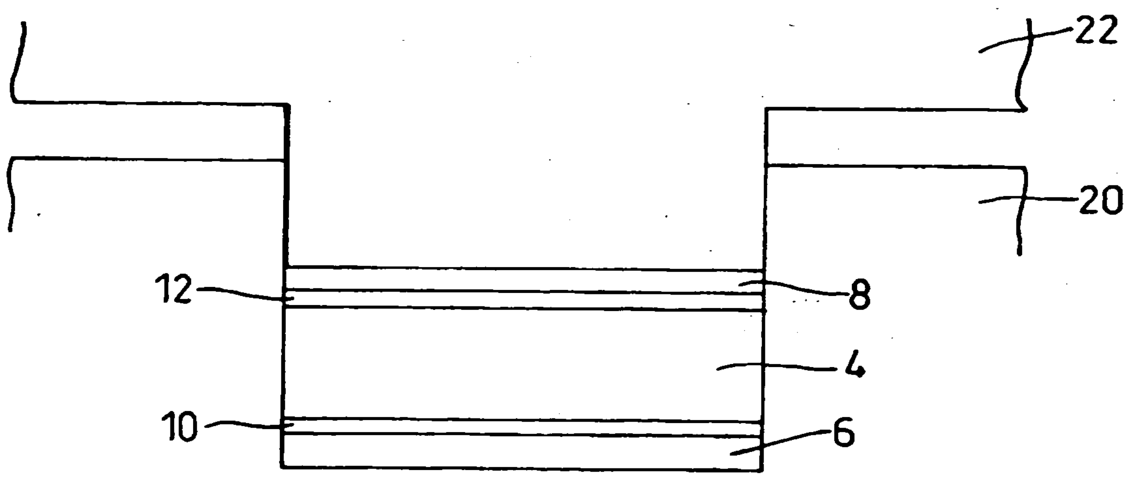

Fig. 4

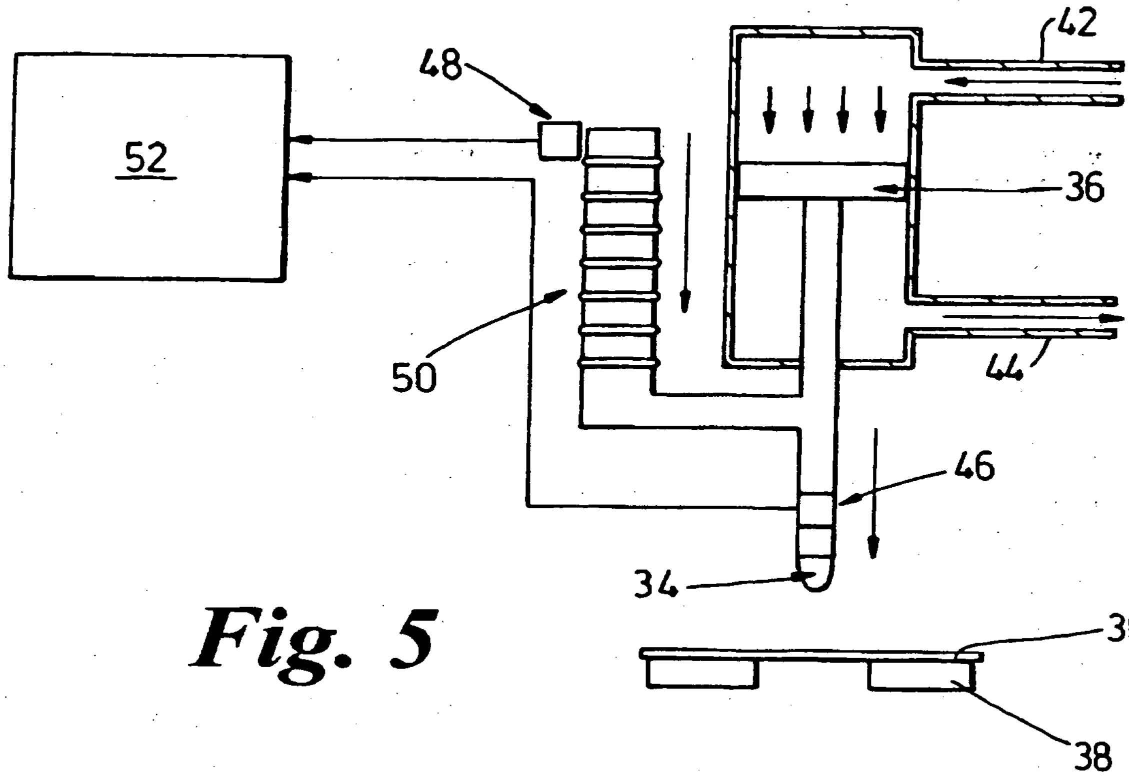

Fig. 5

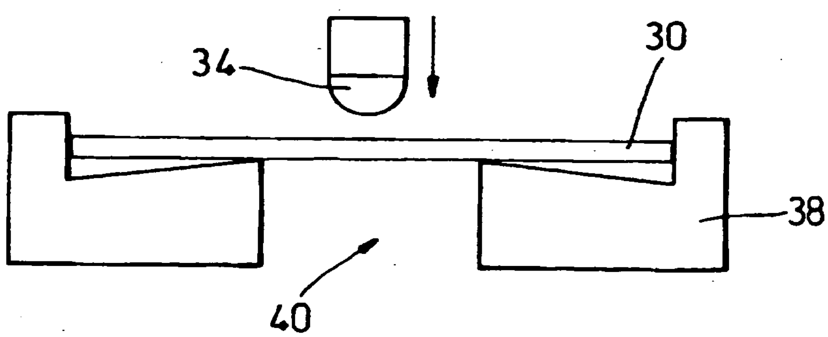

Fig. 6

Composite Structure

The present invention relates to a composite structure. The composite structure has particular utility in the automotive field.

There are a number of non-structural parts in a motor vehicle. Such parts are required, for example, for the purpose of providing trim for a part of the motor vehicle. Such parts may typically be chosen for their aesthetic appearance; structural load-bearing integrity is not a primary requirement. There is thus necessary to provide separate supporting members for such non-structural parts in motor vehicles. The supporting members, however, add weight to the motor vehicle. Accordingly, there is a need for lightweight non-structural parts having sufficient inherent integrity to avoid the need for separate supporting members.

According to a first aspect of the present invention, a composite structure comprises a core of load bearing, impact resistant material, a first layer of a laminate composite comprising aligned continuous glass fibres in a matrix of a thermoplastic material on a first side of the core, and a second layer of a laminate composite comprising aligned continuous glass fibres in a matrix of a thermoplastic material on a second side of the core. Such a structure has the advantage that it provides, or may readily be provided with, a suitable aesthetic finish to a part formed from the composite structure, the composite structure having an inherent rigidity such that no additional supporting members are required.

Preferably the first and second layers of laminate composite are joined to the core by respective layers of a low melt thermoplastic. More preferably, the low melt thermoplastic is polypropylene.

Preferably the core comprises a low density blown foam thermoplastic. More preferably, the blown foam thermoplastic is polypropylene or ethylenepropylene.

Alternatively, the core comprises a honeycomb thermoplastic. More preferably, the honeycomb thermoplastic is polypropylene.

Preferably, the thermoplastic matrix of the laminate composite is polypropylene.

The invention, will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a section through a first composite structure according to the present invention;

Figure 2 shows a section through a second composite structure according to the present invention;

Figure 3 shows a section through a third composite structure according to the present invention;

Figure 4 shows schematically an apparatus for use in the manufacture of a composite structure according to the present invention;

Figure 5 shows a schematic view of an impact tester used to test the composite structure; and

Figure 6 shows diagramatically a view of the anvil of the impact tester of Figure 5.

Referring to Figures 1 to 3 there are shown preferred embodiments of a composite structure 2 according to the present invention. In each embodiment, the composite structure comprises a core 4 of load bearing, impact resistant material. A first layer 6 of a laminate composite comprising aligned continuous glass fibres in a matrix of a thermoplastic material is disposed on a first side of the core. A

second layer 8 of a laminate composite comprising aligned continuous glass fibres in a matrix of a thermoplastic material is disposed on a second side of the core.

In the embodiments of Figures 1 and 2, the first and second layers of laminate composite are joined to the core by respective first and second layers 10,12 of a low melt thermoplastic. The low melt thermoplastic may conveniently comprise a polypropylene. In an alternative embodiment, Figure 3, the low melt thermoplastic may be omitted.

In the embodiment of Figure 1, the core 4 comprises a low density blown foam thermoplastic 14. The blown foam thermoplastic may conveniently comprise a polypropylene or an ethylenepropylene.

In the embodiment of Figure 2, the core 4 comprises a honeycomb thermoplastic 16. The honeycomb thermoplastic may conveniently comprise a polypropylene.

The thermoplastic matrix of the laminate composite in either embodiment may be a polypropylene. A suitable laminate composite is that sold under the trade name PLYTRON.

Manufacture of a composite structure according to the present invention will now be described with reference to Figure 4. Strips of the laminate composite are first heated in an infra-red oven. A first layer 6 of laminate composite strips ar laid up in a first half 20 of a mould. A layer of core material 4 is placed in the mould to overlie the first layer of laminate composite. A second layer 8 of laminate composite strips are then laid up over the layer of core material. A second half 22 of the mould is then used to compress the layers together while the heated layers of laminate composite are allowed to cool. On separation of the first and second

mould halves, a composite structure 2 according to the present invention may be removed.

A first sheet of a low melt thermoplastic 10 may be laid over the first layer of laminate composite strips before the layer of core material is placed in the mould, and a second layer of low melt thermoplastic 12 may be laid over the layer of core material before the second layer of composite strips are placed into position.

In order to test the structural integrity of the composite structure formed, test specimens 30 of the composite structures were tested on an impact testing machine 32 in accordance with that shown on Figures 5 and 6.

An impactor nose 34 is driven by a pneumatic piston 36 into a test specimen 30 positioned on an anvil 38. The anvil is provided with an opening 40 to allow the impactor nose to pass therethrough. The pneumatic piston 36 is provided with passages 42,44 through which gas may be supplied to drive the piston 36 and allow a range of impact velocities to be achieved. By placing the test specimen 30 carefully relative to the impactor nose, an impact event will take place at a constant velocity, away from regions of acceleration and deceleration present within a travel of the impactor nose. The pneumatic piston 36 also incorporates a load cell 46 to generate load data at the impactor nose. A displacement transducer 48 is provided adjacent a graduated optical strip 50. The strip 50 is attached to the piston 36. Passage of the optical strip 50 past the displacement transducer 48 as the impactor nose 34 descends generates displacement data.

The load data and displacement data are fed to a data logger and processor 52 where the data are analysed by suitable data processing software. For best results, the test specimens were cut from a larger specimen using a cutting laser.

It was found when impact testing test specimens of the composite according to the present invention in the above manner that surprisingly good results w re obtained.

CLAIMS

1. A composite structure comprises a core of load bearing, impact resistant material, a first layer of a laminate composite comprising aligned continuous glass fibres in a matrix of a thermoplastic material on a first side of the core, and a second layer of a laminate composite comprising aligned continuous glass fibres in a matrix of a thermoplastic material on a second side of the core.

2. A composite structure according to claim 1, characterised in that the first and second layers of laminate composite are joined to the core by respective layers of a low melt thermoplastic.

3. A composite structure according to claim 2, characterised in that the low melt thermoplastic is polypropylene.

4. A composite structure according to any previous claim, characterised in that the core comprises a low density blown foam thermoplastic.

5. A composite structure according to claim 4, characterised in that the blown foam thermoplastic is polypropylene.

6. A composite structure according to claim 4, characterised in that the blown foam thermoplastic is ethylenepropylene.

7. A composite structure according to any of claims 1 to 3, characterised in that the core comprises a honeycomb thermoplastic.

8. A composite structure according to claim 7, characterised in that the honeycomb thermoplastic is polypropylene.

9. A composite structure according to any previous claim, characterised in that the thermoplastic matrix of the laminate composite is polypropylene.

10. A composite structure substantially as described herein with reference to and as illustrated in the accompanying drawings.

Application No:	GB 9900905.2	**Examiner:**	R.J.MIRAMS
Claims searched:	1 to 10	**Date of search:**	25 March 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): B5N

Int Cl (Ed.6): B32B 3/12, 5/08, 5/12, 5/18, 5/22, 5/24, 5/26, 5/28. B60R 13/02.

Other: ONLINE: WPI, EPODOC, PAJ.

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	EP0355912A2	(Adprotech) e.g. claims 4 and 5	at least 1, 2 and 4
X	JP080048193A	(Hayashi) see abstracts	at least 1 to 3 and 9

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.